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WJEC GCSE Mathematics and Numeracy (Double Award) – Question Pack

Cumulative frequency tracks a running total of values. Plotted against the upper class boundary, it forms a smooth curve from which the median, quartile

REVISE
.wales

3.23 – Cumulative frequency

Spec 4.2.18 – Unit 3 (calculator allowed)

Cumulative frequency tracks a running total of values. Plotted against the upper class boundary, it forms a smooth curve from which the median, quartiles and any percentile can be read directly. Sourced from legacy WJEC GCSE Mathematics and Mathematics-Numeracy papers, organised for revision under the 2025 spec.

2025 SPECIFICATION

Estimated time for entire question pack: ~45 minutes

Derived from the GCSE Higher pace of ~1.5 min/mark (30 marks across 11 questions).

*You are advised to **not** attempt to complete all of this in one sitting.*

ABOUT THIS QUESTION PACK

This is a **focused single-topic practice pack**, not a single mock paper. Questions are organised against the 2025 specification. Questions are ordered chronologically by sitting, with custom-written and SAM questions at the end.

INSTRUCTIONS

Use black ink or black ball-point pen. Show all working – method marks are awarded for clear setup.

A calculator is allowed on every question in this pack (Unit 3 is the calculator-allowed paper).

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Cumulative frequency – what the new spec asks

WJEC GCSE Mathematics (first teaching 2025) · Unit 3: calculator-allowed.

Cumulative frequency tables & curves 4.2.18

- Construct a cumulative frequency table from a grouped frequency table.
- Plot cumulative frequency against the upper class boundary; join with a smooth curve.
- Read off the median ($CF = n/2$), quartiles ($CF = n/4, 3n/4$) and any percentile.
- Use the curve to estimate the number or proportion of values above or below a given threshold.

Cumulative frequency in one page

Quick-reference notes – revisit before each question. Don't use during the questions.

What is cumulative frequency?

A *running total* of frequencies, working down the class table.

The final cumulative frequency equals n , the total number of data points.

Building a CF table

Add an extra column to the grouped frequency table.

Each row's cumulative frequency = previous CF + this row's frequency.

Check: the last value in the column must equal $\sum f$.

Plotting the CF curve

Plot each cumulative frequency against the *upper class boundary*, not the midpoint.

Join the points with a smooth curve (or straight segments if the question allows).

The curve starts at zero CF at the lower bound of the first class.

Reading the median

The median is the value where $CF = \frac{n}{2}$.

Draw across from $\frac{n}{2}$ on the CF axis to the curve, then down to the value axis.

Show the construction lines for method marks.

Reading the quartiles

Q_1 : $CF = \frac{n}{4}$. Q_3 : $CF = \frac{3n}{4}$.

Same procedure as the median – draw across, then down.

$IQR = Q_3 - Q_1$, read directly from the value axis.

Reading any percentile

For the p -th percentile, use $CF = \frac{p}{100} \times n$.

e.g. the 90th percentile is at $CF = 0.9n$.

Useful for 'top 10%' or 'bottom 30%' style questions.

'How many above / below?'

To estimate how many values are below v : read up from v to the curve, then across to CF.

How many *above* $v = n - CF(v)$.

Express as a count or a proportion as needed.

Comparing two CF curves

On the same axes, the curve that's further to the *right* has higher values overall.

The steeper the curve, the more values clustered in that range.

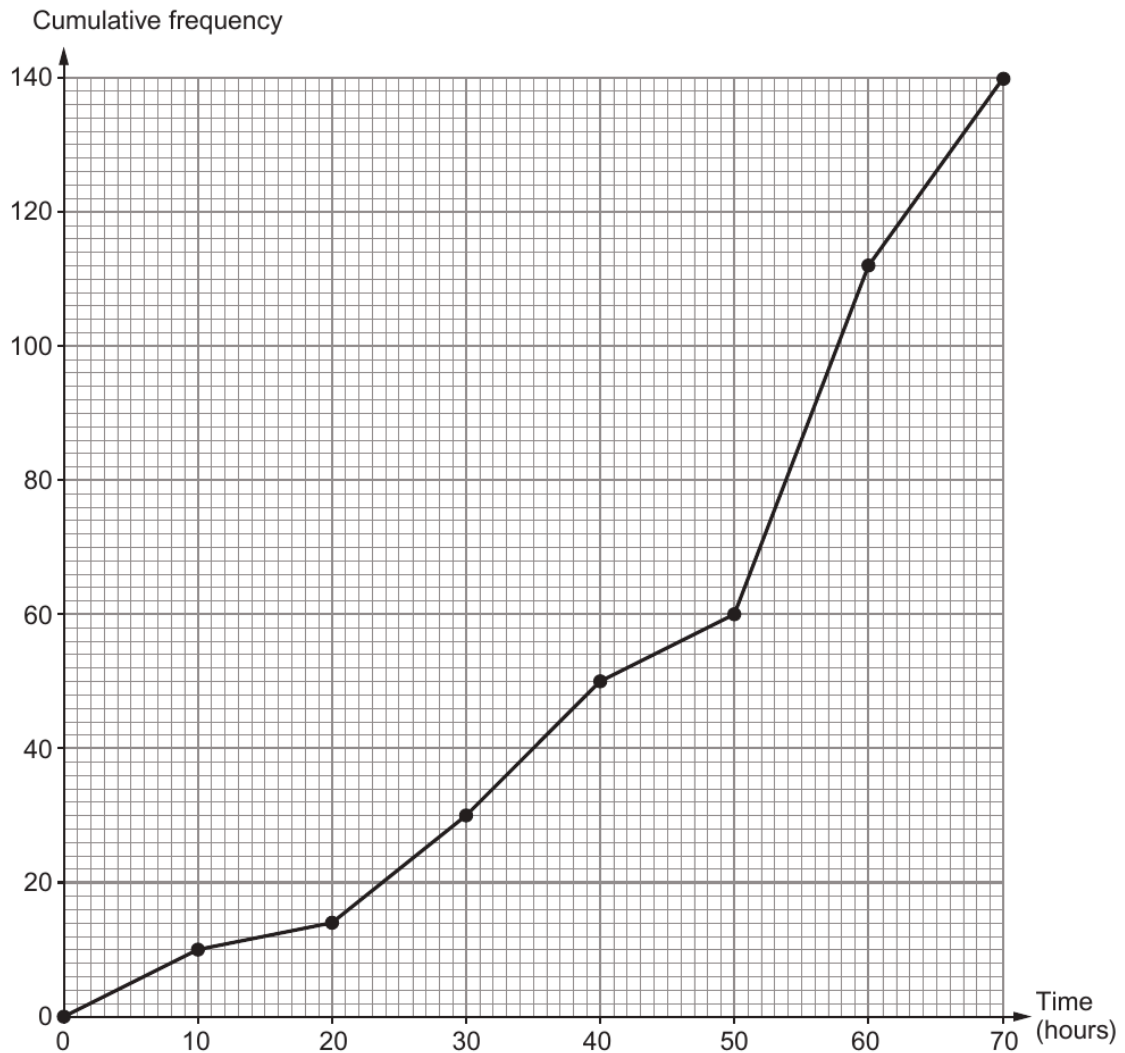
Read off both medians and both IQRs to compare formally.

Common traps

- Plotting CF at the class midpoint instead of the upper boundary.
- Reading $\frac{n}{2}$ on the value axis instead of the CF axis.
- Forgetting the first point at $CF = 0$ (lower bound of first class).
- Joining points with sharp corners when the question expects a smooth curve.

Examiner only

4. (a) 140 girls were asked how long they spent revising for their GCSE examinations. The cumulative frequency diagram shows the results.



- (i) Estimate the median time the girls spent revising.
Circle your answer.

[1]

35 hours 40 hours 48 hours 52 hours 70 hours

- (ii) Calculate the number of girls who spent between 40 and 50 hours revising.
Circle your answer.

[1]

0 girls 5 girls 10 girls 15 girls 20 girls



(iii) Circle either TRUE or FALSE for each of the following statements.

[2]

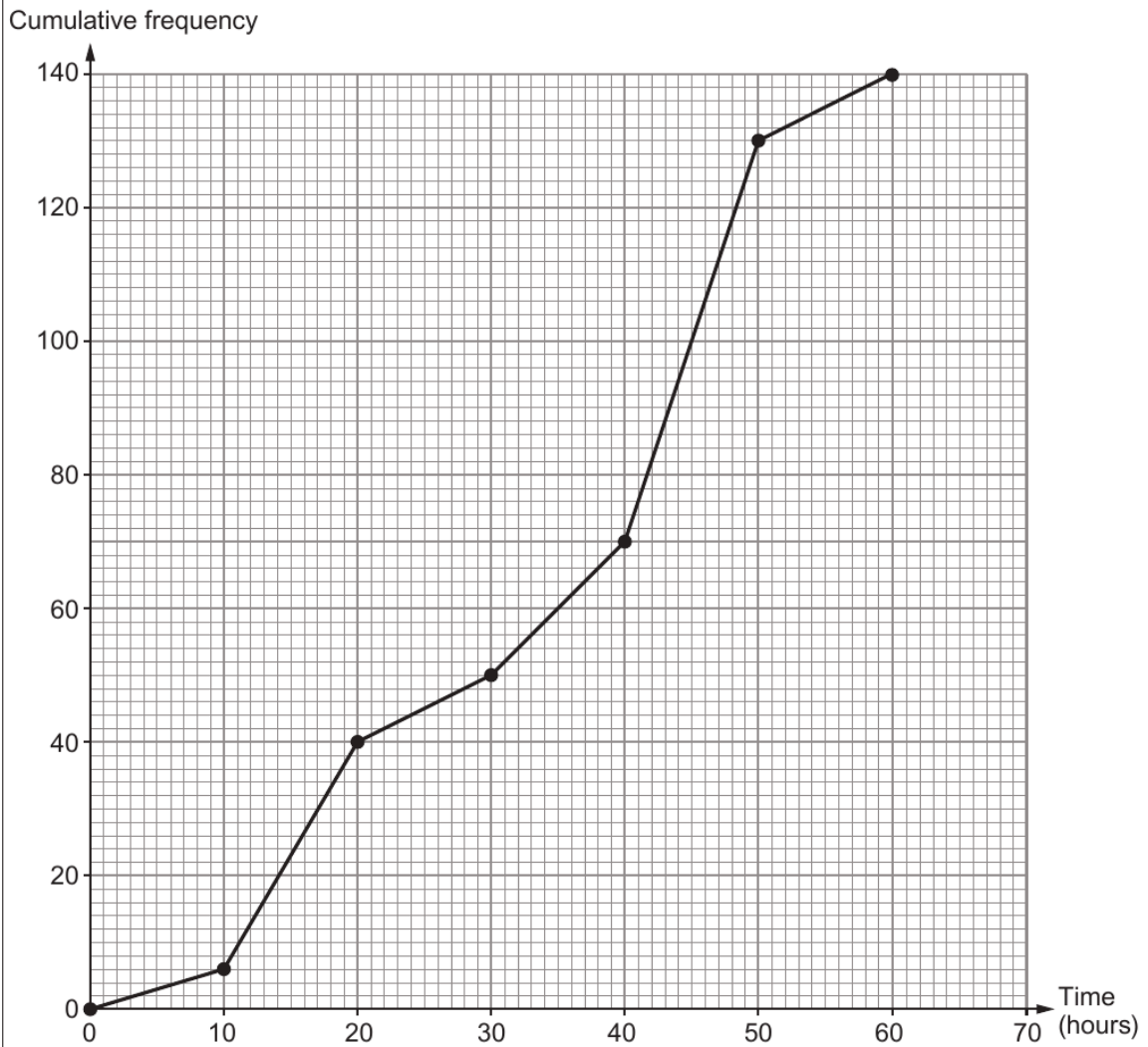
Examiner
only

25 girls spent between 30 and 50 hours revising.	TRUE	FALSE
No girls spent more than 80 hours revising.	TRUE	FALSE
The modal group is between 50 and 60 hours spent revising.	TRUE	FALSE
20 girls spent more than 60 hours revising.	TRUE	FALSE



Examiner
only

(b) 140 boys were asked how long they spent revising for their GCSE examinations. The cumulative frequency diagram below shows the results.



Examiner
only

Trefor makes two statements.

- 1. The boys' interquartile range is greater than the girls' interquartile range.
- 2. On average, boys spent more time revising.

Are both Trefor's statements correct?
Show calculations and give reasons to support your answers.

[4]

Statement 1:

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Statement 2:

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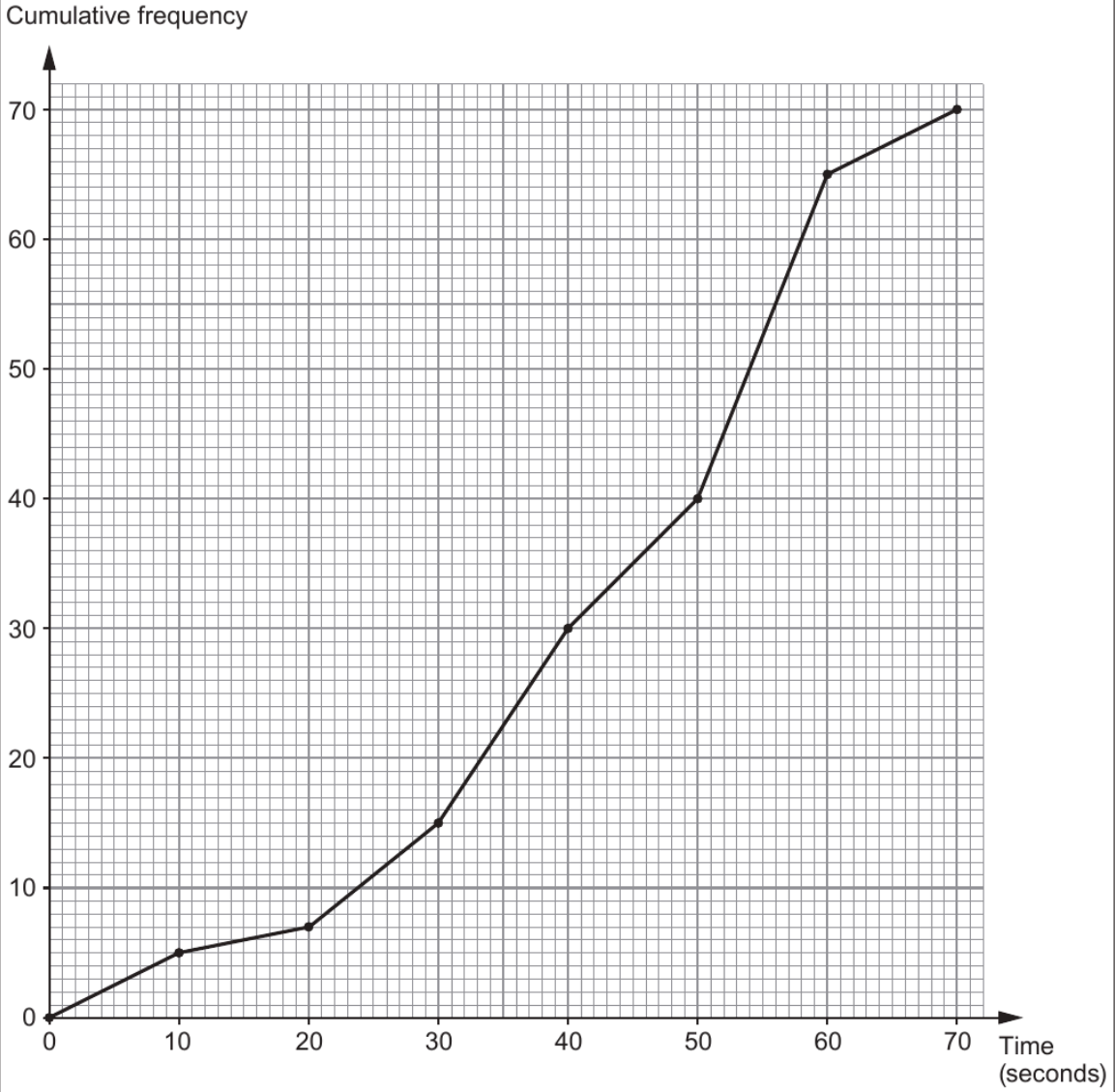
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Examiner only

5. Cambria Airlines has planes that can carry up to 70 passengers. For safety, the crew practise the emergency exit procedures with a group of 70 passengers. Every 10 seconds the safety officer records the total number of passengers who have left the plane. He has displayed the results in the cumulative frequency diagram shown below.



- (a) Estimate the median time taken by the passengers to leave the plane. [1]

..... seconds



Examiner
only

(b) How many passengers took more than 50 seconds to leave the plane?
Circle your answer. [1]

10 20 30 40 50

(c) Cambria Airlines has a policy that states the following.

'In the event of an emergency exit procedure, at least 90% of the
70 passengers must have left the plane within 1 minute.'

Did the practice emergency exit procedure meet the requirements of the airline's policy?
You must show all your working. [4]

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13



3.



Meirion's Window Cleaning Business

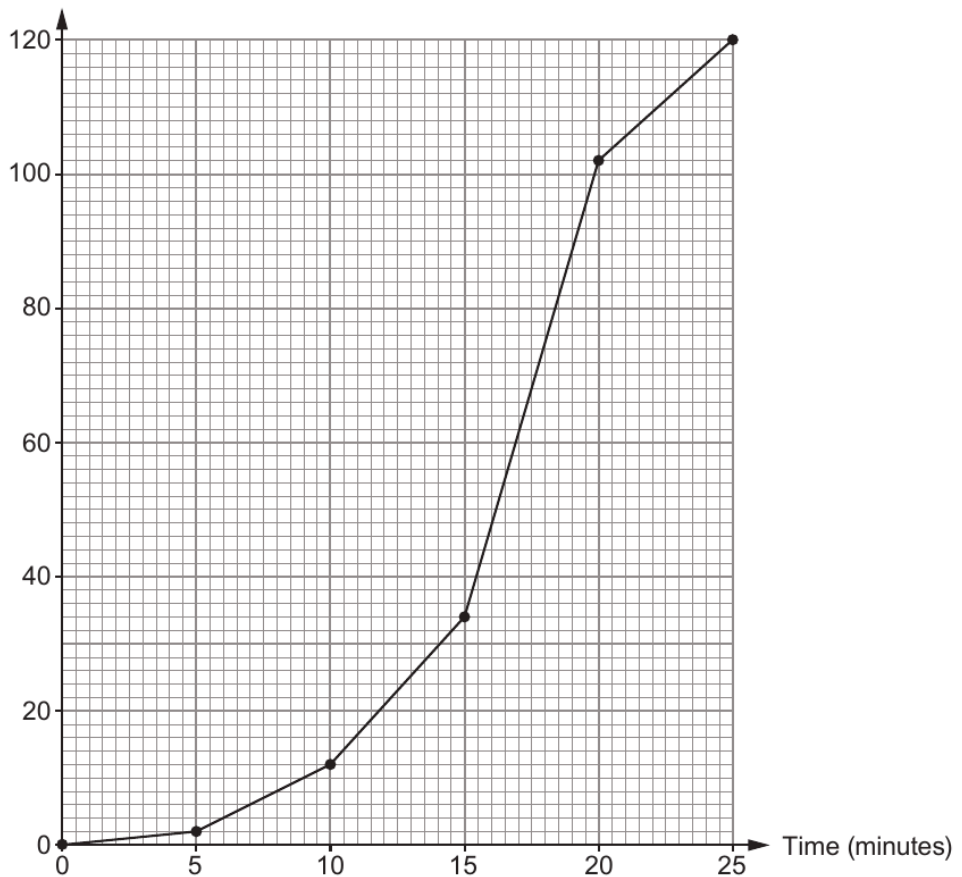
No job too small!

Email: meirion@mwcb.cymru

Meirion is a window cleaner.
From Monday to Friday, he records how long he spends cleaning windows for each of his customers.

He draws a cumulative frequency diagram to display the findings.

Cumulative frequency



Examiner
only

- (a) (i) Use Meirion's cumulative frequency diagram to find the median and interquartile range of the times he spends cleaning windows for each of his customers. [3]

Median minutes

Interquartile range minutes

- (ii) Meirion looks back at his raw data.
He finds that the median is actually 17 minutes 30 seconds.
Why is there a difference between the median from his cumulative frequency diagram and the actual median from his raw data? [1]

- (b) Meirion is looking at the time it took to clean individual customers' windows.
Find the number of customers whose windows took between 10 and 15 minutes to clean. [2]

- (c) Meirion thinks that for approximately 80% of his customers, he cleaned their windows in less than 20 minutes.
Is Meirion correct?
You must show all your working. [3]

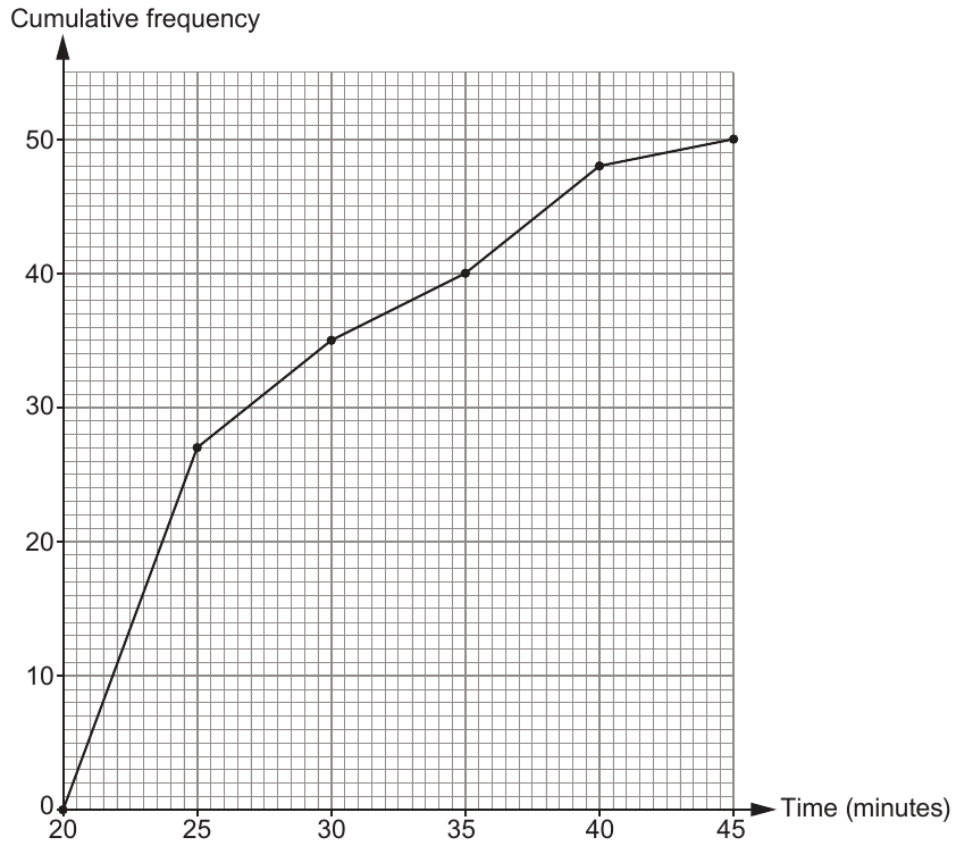
3310U501
09



Examiner
only

6. This year, 50 runners took part in a 5 km race in the Brecon Beacons. All 50 runners finished the race.

The cumulative frequency diagram below shows the times taken by the runners to finish the race.



- (a) Which is the modal group?
Circle your answer.

[1]

20 to 25 minutes

25 to 30 minutes

30 to 35 minutes

35 to 40 minutes

40 to 45 minutes

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.....



Examiner
only

(b) Is it certain that the last runner's finish time was 45 minutes?
You must give a reason for your answer.

[1]

Yes

No

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(c) The organisers hoped that 80% of the runners would finish the race within 30 minutes.

Complete the following two statements.

[2]

'..... % of runners finished the race within 30 minutes.'

'80% of runners finished the race within minutes.'

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(d) Last year, the median finish time was 26 minutes.
By how many minutes was the median time better this year?
You must show all your working.

[2]

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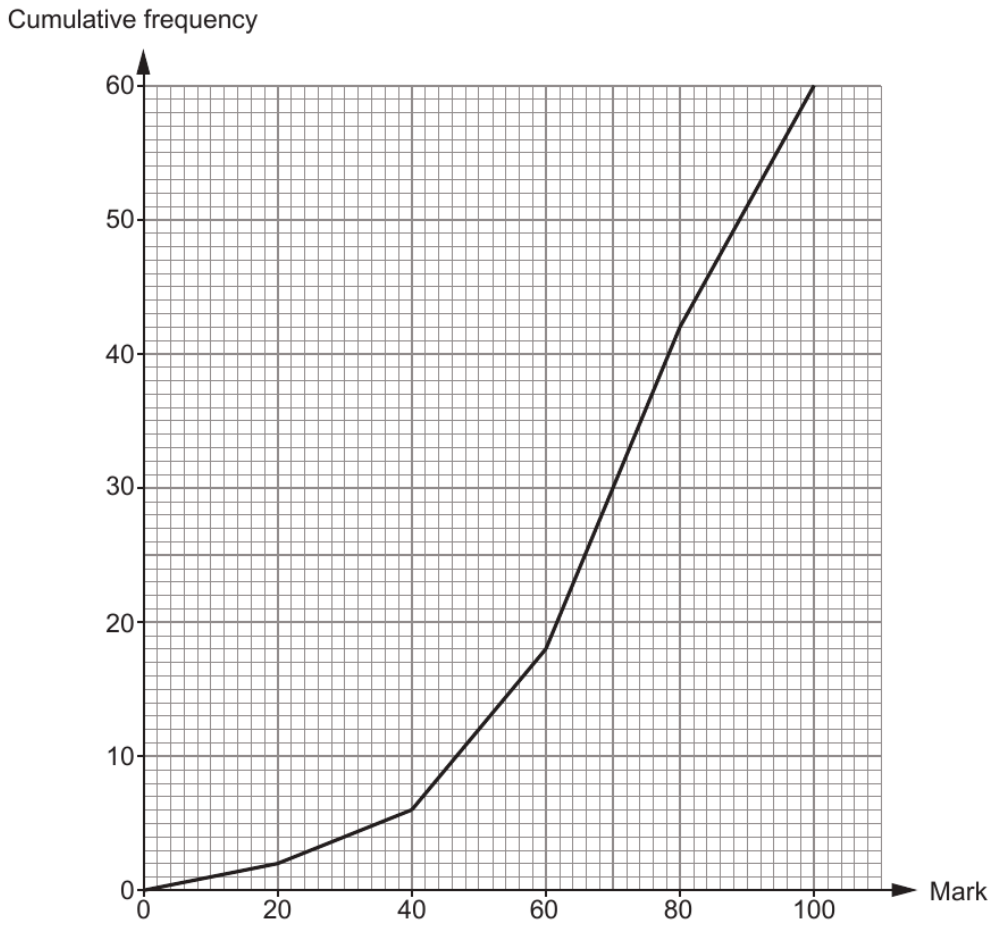
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Examiner only

9. A group of pupils sat a mathematics test. The teacher grouped their marks using the intervals 1 to 20, 21 to 40, and so on. She then drew the following cumulative frequency diagram to display the results.



- (a) Phoebe is one of the pupils who sat the test. Phoebe says, 'The cumulative frequency diagram shows that the median mark was 70.'

Explain why the median mark may not be 70.

[1]

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(b) Consider the pupils who had a mark of 80 or less.

How many of these pupils would have needed to score more than 80 for Phoebe's estimate of the median to be 80?

Circle your answer.

[1]

10

12

18

5

20

Examiner
only



Examiner only

5. (a) *Kenworth Electrical* specialises in wiring new houses. The monthly wages of all *Kenworth Electrical* employees are summarised in the frequency table below.

Monthly wage, £ x	Frequency
$1800 \leq x < 2000$	64
$2000 \leq x < 2100$	50
$2100 \leq x < 2400$	2
$2400 \leq x < 5800$	0
$5800 \leq x < 7800$	4

- (i) In which group does the median monthly wage lie?
Circle your answer.

[1]

$1800 \leq x < 2000$

$2000 \leq x < 2100$

$2100 \leq x < 2400$

$2400 \leq x < 5800$

$5800 \leq x < 7800$

.....

- (ii) Alysia is an accountant working for *Kenworth Electrical*. She knows the exact wage of each employee.

Alysia says,

It would be misleading to use the mean monthly wage as an average.

Explain why Alysia has reached this conclusion.

[1]

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3310U601
11



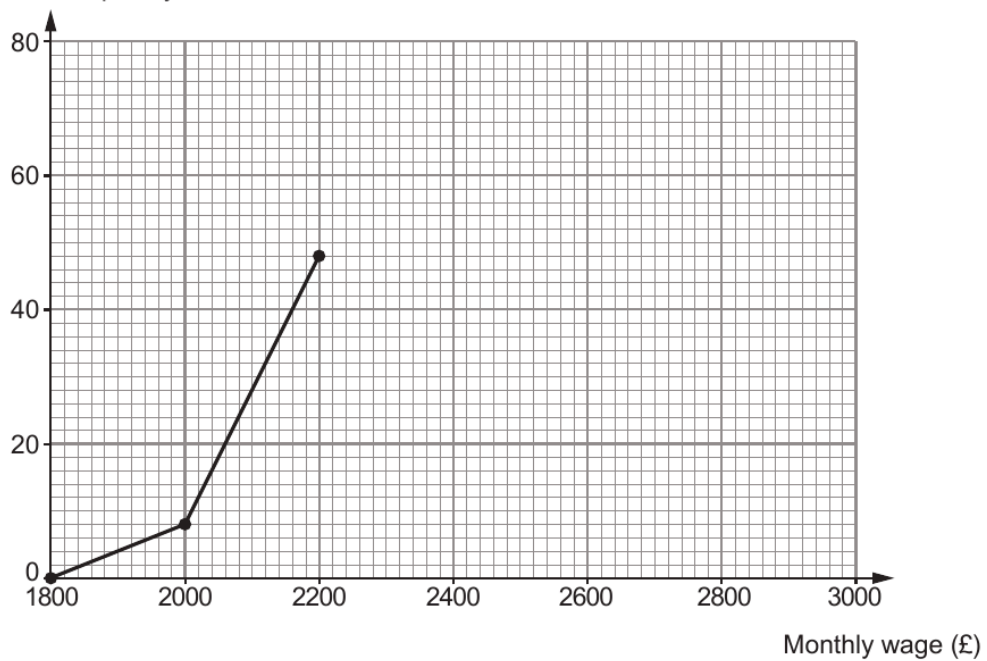
Examiner only

- (b) *Maesteg Electrical* also specialises in wiring new houses. The monthly wages of all *Maesteg Electrical* employees are summarised in the frequency table below.

Monthly wage, £ x	Frequency
$1800 \leq x < 2000$	8
$2000 \leq x < 2200$	40
$2200 \leq x < 2400$	24
$2400 \leq x < 3000$	8

- (i) Use the frequency table to complete the following cumulative frequency diagram to display the monthly wages of all *Maesteg Electrical* employees. [2]

Cumulative frequency



Use the cumulative frequency diagram to answer each of the following questions.

- (ii) Which of the following is the best estimate for the median monthly wage of *Maesteg Electrical* employees? Circle your answer. [1]

£2100 £2160 £2200 £2360 £3000

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- (iii) Calculate an estimate of the percentage of *Maesteg Electrical* employees who have a monthly wage of less than £2050.
You must show all your working. [2]

Examiner
only

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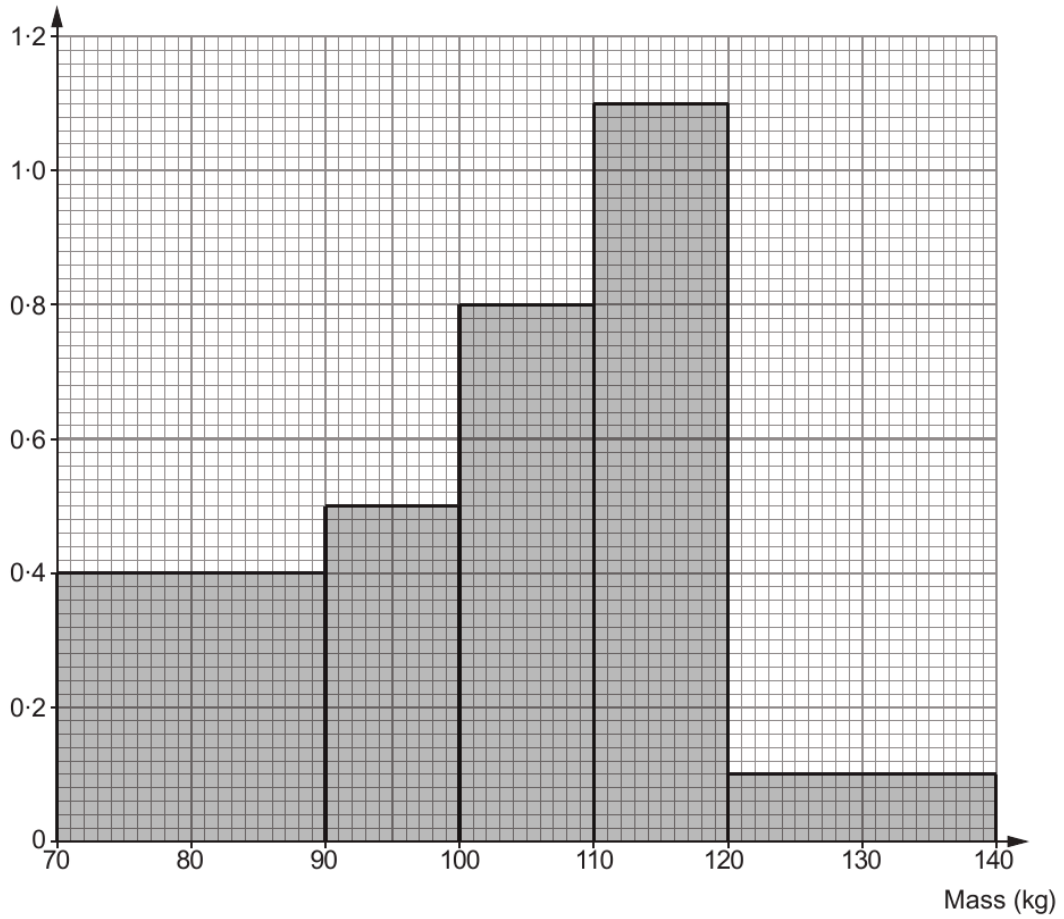
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Examiner only

7. The masses of the players in the men's 2017-2018 Wales rugby squad are shown in the histogram below.
The squad consisted of 34 players.

?



- (a) The label is missing on the vertical axis. What should the label be?
Circle your answer.

[1]

Frequency

Number of players

Density

Cumulative frequency

Frequency density



Examiner
only

(b) Ben says,

"The histogram shows that the mass of the heaviest member of the squad was double the mass of the lightest member of the squad."

Is Ben correct?

Yes

No

You cannot tell

You must give a reason for your choice.

[1]

Reason:

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(c) The *Forwards* were the heaviest players in the squad.

The lightest *Forward* had a mass of 104 kg.

Calculate the **maximum** possible number of *Forwards* there could have been in the squad.

You must show all your working.

[3]

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(d) To make a comparison with other teams, the coach wanted to know the mean mass of all the players in the squad.

Use the histogram to calculate an estimate of the mean mass of all the players in the squad.

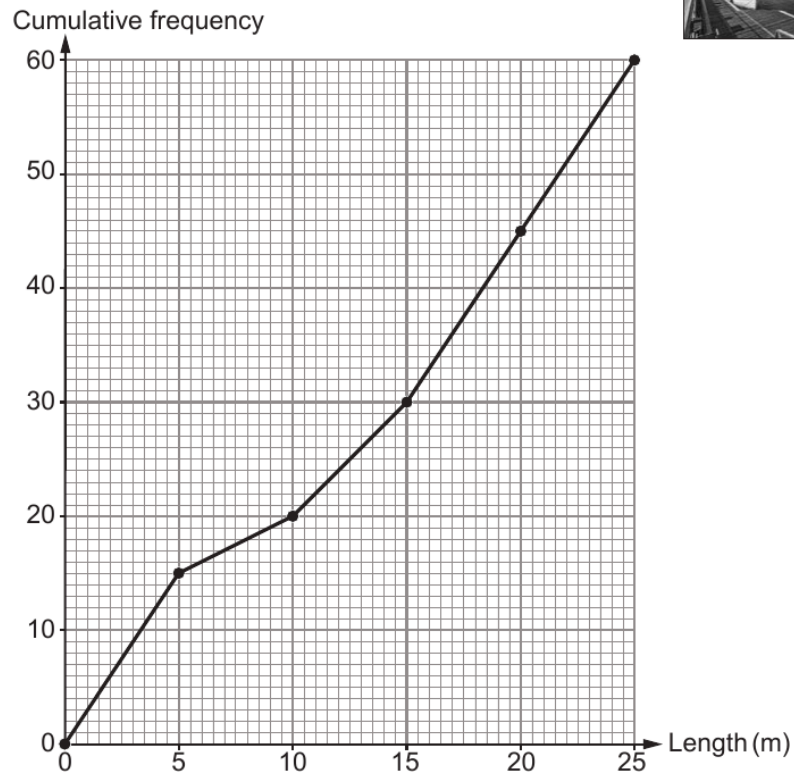
[5]

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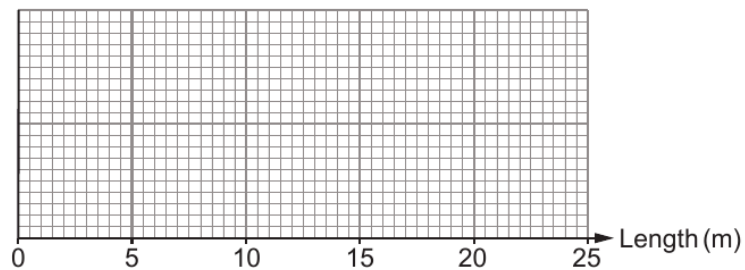
Examiner only

3. (a) The lengths of the 60 yachts in Eog Marina were measured. The results are shown in the cumulative frequency diagram below.



The shortest yacht has a length of 3 m.
The longest yacht has a length of 22 m.

Use the information above to complete a box-and-whisker diagram on the graph paper below. [3]



Examiner
only

(b) The lengths of the 68 yachts in Clwyd Marina were measured.

For these yachts:

- the lower quartile of their lengths is 10 m
- 25% have lengths greater than 18 m
- the median length is 11.6 m.

(i) Calculate how many of the yachts in Clwyd Marina have lengths greater than 10 m. [2]

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..... yachts

(ii) In which marina, Eog or Clwyd, is the interquartile range of the lengths of the yachts greater?

Eog Marina Clwyd Marina

You must show all your working. [2]

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(iii) In which marina is the longest yacht?

Eog Marina Clwyd Marina Can't tell

You must give a reason for your answer. [1]

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3310U501
09



4. Giovanni has a takeaway pizza van. He sells whole pizzas and slices of pizza from his van.



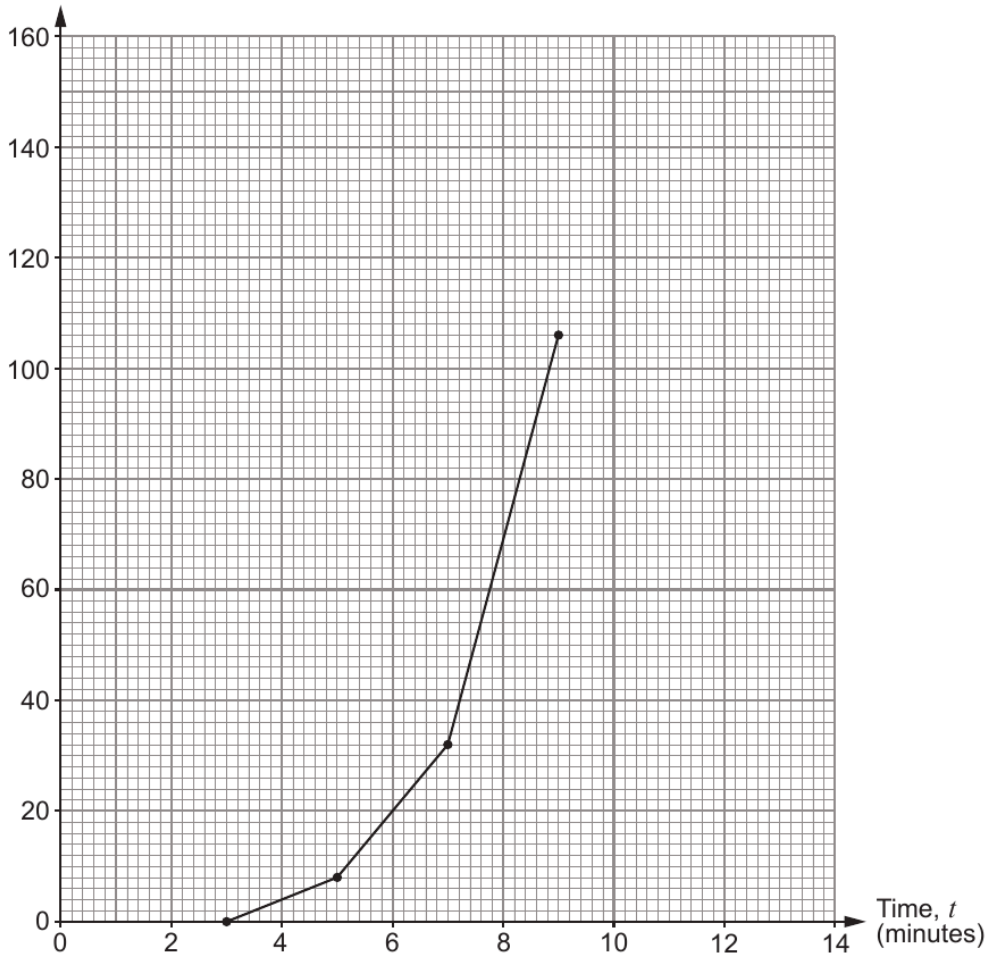
Examiner only

(a) For the last 3 days, he has timed how long it takes to complete the food order for each of his customers. Giovanni recorded his results in the table below.

(i) Complete the cumulative frequency table **and** the cumulative frequency diagram. [2]

Time, t (minutes)	Frequency	Cumulative frequency
$3 < t \leq 5$	8	8
$5 < t \leq 7$	24	32
$7 < t \leq 9$	74	106
$9 < t \leq 11$	40
$11 < t \leq 13$	14

Cumulative frequency



Examiner only

Use your cumulative frequency diagram to give the best estimates for the answers to each of the following questions.

- (ii) Find the median time taken to complete a food order. [1]

The median time is minutes.

- (iii) Giovanni is concerned that food orders are taking too long to complete. He says,

"Only 25% of the food orders are completed in under minutes."

Use **one** of the five values below to complete Giovanni's statement. [1]

6.4 6.6 7.2 8 9.6

- (iv) Calculate the percentage of orders that were completed in less than 6 minutes. [2]

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- (b) For the last 3 days:
 - Giovanni spent £180 on ingredients
 - he spent £220 on the running costs for the pizza van
 - he received a total of £700 from the food orders.

Calculate Giovanni's percentage profit. [3]

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- (c) Next year Giovanni intends to charge £8.40 for a basic pizza. This is an increase of 20% from the current charge.

Calculate how much Giovanni currently charges for a basic pizza. [2]



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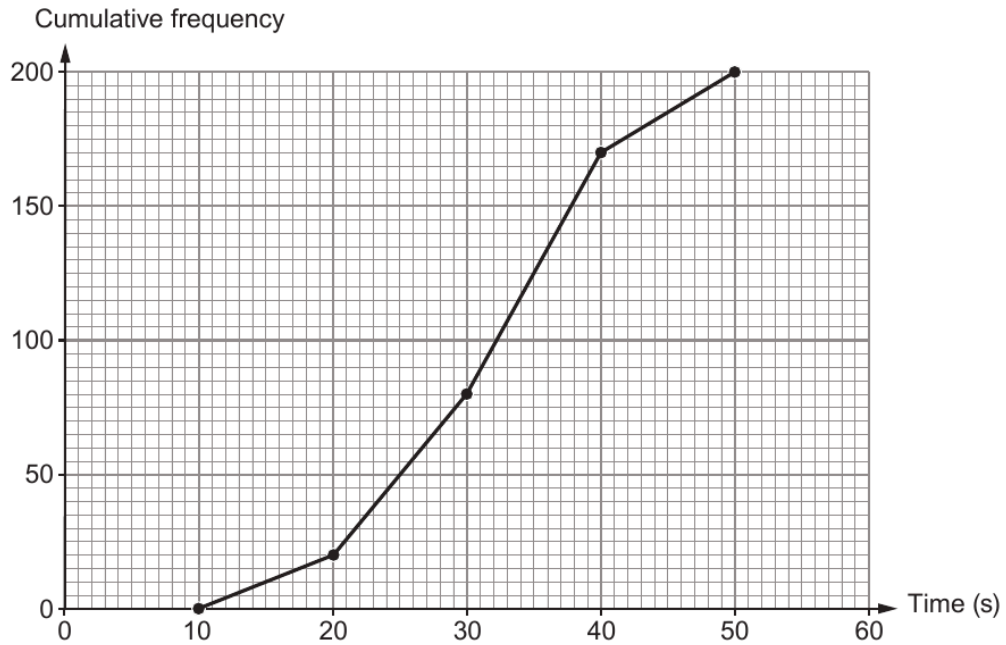
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3310U501
09



Examiner only

4. (a) On 1st June last year, 200 customers used cash to pay at Shop Lil. The cumulative frequency diagram represents the time each of these 200 customers waited to be given change at the checkout.



- (i) How many of these customers waited between 30 and 50 seconds for their change? [2]

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- (ii) Use the graph to estimate the median time these 200 customers waited for their change. Circle your answer. [1]

24 seconds 32 seconds 38 seconds 80 seconds 100 seconds

- (iii) Calculate the fraction of these 200 customers who waited 40 seconds or longer for their change. Give your answer in its simplest form. [2]

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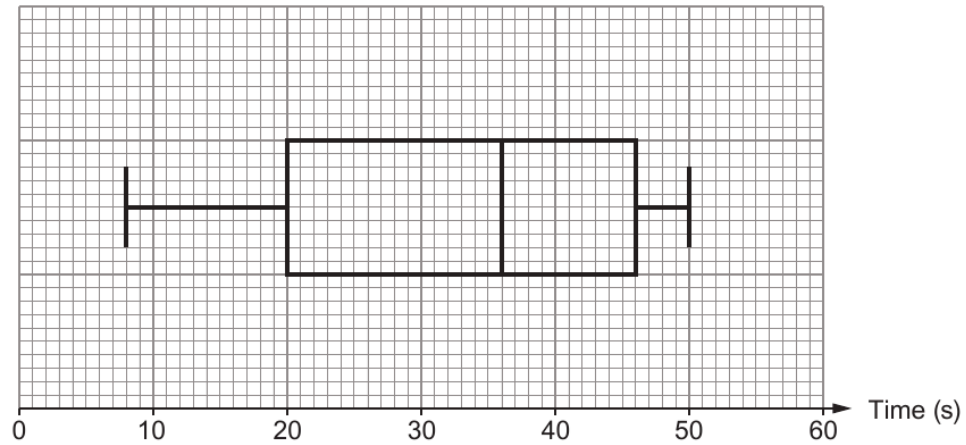
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Examiner only

- (b) On 1st June this year, the manager at Shop Lil drew a box-and-whisker plot of the times 200 customers waited for their change at the checkout.



Based on the results of these 200 customers, the manager made the following statements. Complete the statements.

- (i) "On 1st June this year, 50% of our customers were given their change in seconds or less." [1]
- (ii) "On 1st June this year, the interquartile range of the times taken to give customers their change was seconds." [2]

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- (c) Consider the 50 customers waiting the **longest** times to get their change on 1st June last year and this year.
Has the speed of giving change at the checkout improved since last year?

Yes No

You must give a reason for your answer. [1]

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3310U501
09

4. Aderyn is a company that makes bird feeders.

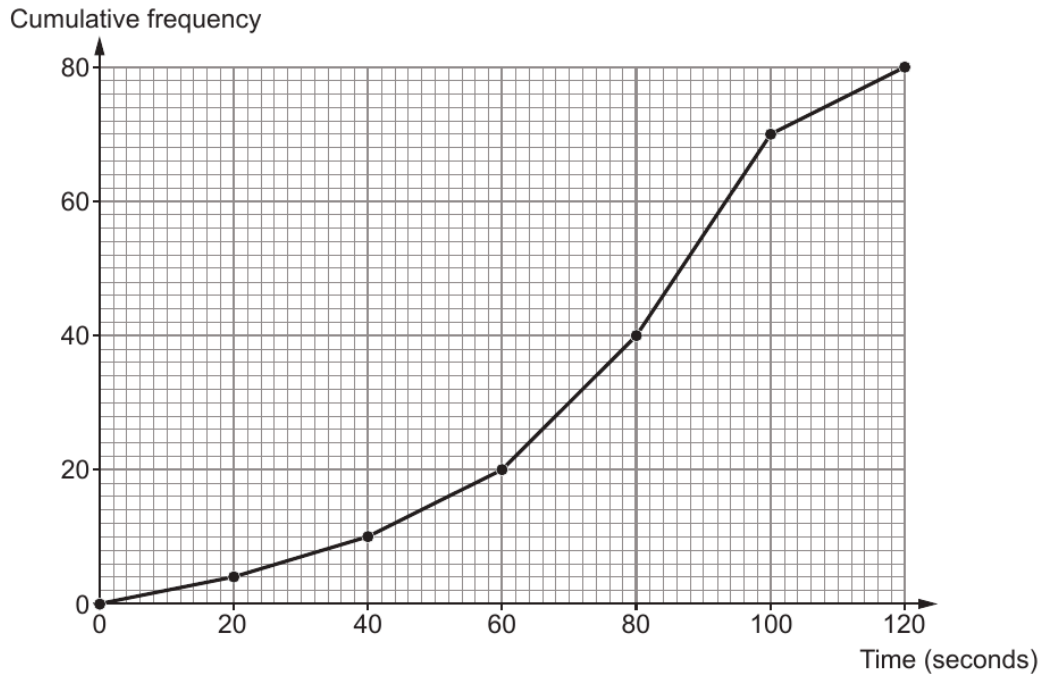
Squirrels often try to steal food from bird feeders.

To make this more difficult, Aderyn has designed a **new** bird feeder. Aderyn tests its new feeder to check how long it takes squirrels to reach the food inside.



The results are displayed in the cumulative frequency diagram below.

New bird feeder



(a) Aderyn has the following information about the time it took squirrels to reach the food in its **original** bird feeder.

Original bird feeder	
Modal group	60 to 80 seconds
Median time	75 seconds
Interquartile range	20 seconds



Examiner
only

Aderyn compared the times squirrels take to reach the food in the original bird feeder and the times they take to reach food in the new bird feeder.

(i) Complete this sentence:

'The modal group for the new bird feeder is between and seconds.'

Does the modal group for the new bird feeder imply that there is an improvement in the times? [1]

Yes No

(ii) Use the cumulative frequency diagram and the table to give the best estimate to complete each of the following sentences.

I. 'The difference between the median times is seconds.' [1]

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II. 'The difference between the interquartile ranges of the times is seconds.' [2]

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(b) Use the cumulative frequency diagram to give the best estimate to complete the following sentence. [3]

'20% of the squirrels took seconds or more to reach the food in the new bird feeder.'

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Examiner only

- (c) The population density of grey squirrels in forests depends on the variety of tree that grows there.

Variety of tree	Typical population density of grey squirrels per km ²
Oak	1200
Chestnut	100
Pine	45



Rhian says,

I know that Maesgwyn forest has only one variety of tree: oak, chestnut or pine.

Maesgwyn forest covers an area of 21 500 m².
There are 24 grey squirrels living in Maesgwyn forest.

From this information, which variety of tree is most likely to be found in Maesgwyn forest?

You must show working to support your answer.

[3]

Oak Chestnut Pine

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